REMARKS

The above amendments are made in response to the first Office Action mailed February 21, 2003, wherein:

1. the disclosure was objected to for a number of informalities;
2. the drawings were objected to under 37 CFR 1.83(a) for not showing every recited feature of the claims;
3. Claims 2, 4, and 14 were rejected under 35 U.S.C. § 112, second paragraph, for being indefinite;
4. Claims 1, 3, 6, 7, 10-13, 15, 18, and 20 were objected to for various reasons;
5. Claims 1, 2, 5, 2, 8, 10, and 11 were rejected under 35 U.S.C. § 102(a) as being anticipated by published French patent application No. 2,462,787 to Crochet (the "Crochet Application");
6. Claims 3, 4, 9, 12 , and 13-17 were rejected under 35 U.S.C. § 103(a) as being obvious over the Crochet Application considered alone; and
7. Claim 6 was rejected under 35 U.S.C. §103(a) as being obvious over the Crochet Application in view of U.S. Patent Nos. 5,585,768 to Wei (the "Wei patent").

In response, the Claims, Specification and Drawings have been amended. These amendments are in compliance with the REVISED MANNER OF MAKING AMENDMENTS procedure described in the M.P.E.P §714(III). Specifically, Claims 1, 2, 4, 6, 7, 9, 10, 12-15, 17, 19, 20 have been amended to address the objections and the rejections under §112; the subject matter of Claim 3 has been incorporated into Claim 1; the subject matter of Claim 18 has been incorporated into Claim 13; Claims 3 and 18 have been cancelled without prejudice; Claim 10 has been amended to recite an additional featured disclosed by the original application; and new Claims 21-23 have been added. Additionally, amendments to the drawings have been made to correct FIGS. 4 and 5, and to add FIG. 8 to address the objection under 37 C.F.R. 1.83(a). The Specification has been amended to refer to FIG. 8, and to address the objections noted by the Examiner. Applicants respectfully submit that no new matter has been entered by the amendments. Below, Applicants provide reasons as to why the pending claims, as amended, are allowable over the cited prior art. **Claims 1, 2, 4-17, 19, and 20 and new Claims 21-23 are pending in the application.**

Response to the Objection to Informalities of the Specification

In the Office Action, the Examiner requested that the following reference numbers be described with respect to specific figures as follows:

FIG. 1: 29, 39, and 50.

FIG. 2: 12, and 14.

FIGS. 3 and 4: 26, 28, and 34.

FIG. 3: 39.

FIG. 4: 1, 24, and 30.

FIG. 5: All reference elements shown in the figure except for 24, 28', 28", and 32.

Applicants respectfully submit that reference number 50 was described with respect to FIG. 1 at page 4, lines 28-29 of the Specification as originally filed. With the Amendment, the Specification has been amended to include these reference numbers at points where the figures are described. In addition, FIG. 5 has been amended to change the reference number 20 to 20' so as distinguish the different configuration of the capacitive diaphragms 28' and 28". In addition, the Specification has been amended to address the other objections noted by the Examiner.

Applicants respectfully submit that no new matter has been entered by these amendments.

Response to the Objections and Rejections under §112 to the Claims

The claims have been amended to address the objections and rejections under §112. These amendments do not enter new matter. Except for the amendment to Claim 4, these amendments are straight forward. Claim 4 has been amended to indicate that it is a portion of the *ground ring* that lies opposite to a portion of the conductive trace, rather than the original recitation of the *ground plane*. This feature is shown by original FIGS. 1 and 2, where trace 30 and ground ring 22 lie on opposite surfaces of substrate 1, and is recited by original Claim 9. Accordingly, no new matter is entered by these amendments.

Further Amendments to the Claims

Claim 7 has been amended to recite that the capacitive diaphragm comprises conductive material. This amendment is supported by the original Specification at page 6, lines 12-13, and

therefore does not enter new matter.

Claim 9 has been amended to remove duplicative subject matter in view of the incorporation of Claim 3 into Claim 1.

Claim 10 have been amended to indicate that each of the ground ring and the capacitive diaphragm comprise conductive material. These amendments are supported by the original Specification at page 5, lines 15-17, and page 6, lines 12-13. Claim 10 has also been amended to recite a gap between the patch antenna and the conductive material of the ground ring and capacitive diaphragm, with the gap having a non-uniform width. This feature is supported by FIGS. 1 and 5 of the application, which show a gap between patch antenna and the combined conductive material of ground ring 22 and capacitive diaphragms 28, 28' and 28", with the gap having a non-uniform width. Accordingly, Applicants respectfully submit that no new matter has been entered.

In Claim 14, "area" has been changed to "conductive material" in order to have proper antecedent basis to the recitation of "closed-loop strip of conductive material" recited in base independent Claim 13. Accordingly, Applicants respectfully submit that no new matter has been entered.

Support for New Claims 21-23.

New Claim 21 is dependent upon dependent Claim 8 and recites that each of the ground ring and the capacitive diaphragm comprise conductive material, which is supported by the original Specification at page 5, lines 15-17, and page 6, lines 12-13. New Claim 21 also recites a gap between the patch antenna and the conductive material of the ground ring and capacitive diaphragm, with the gap having a non-uniform width. This feature is supported by FIGS. 1 and 5 of the application, which show a gap between patch antenna 24 and the combined conductive material of ground ring 22 and capacitive diaphragms 28, 28' and 28", with the gap having a non-uniform width. Accordingly, Applicants submit that new Claim 21 does not enter new matter.

New Claim 22 is dependent upon Claim 21 and recites a first spacing distance between the patch antenna and the *capacitive diaphragm*, and a second spacing distance between the patch antenna and the *ground ring*, with the first and second spacing distances being unequal. These features are also supported by FIGS. 1 and 5 of the application, which show patch antenna

24 having difference spacing distances between capacitive diaphragm 28 (28' and 28") and ground ring 22. Accordingly, Applicants submit that new Claim 22 does not enter new matter.

New Claim 23 recites the same features as new Claim 22, but is dependent upon Claim 10 rather Claim 8, and is supported for the same reasons as new Claim 22. As with Claim 22, Applicants submit that new Claim 23 does not enter new matter.

Response to the Rejection of Claims 1, 2, 5, 7, 8, 10, and 11 as Being Anticipated by the Crochet Application, and the Rejection of Claims 3, 4, 9, and 12 as being Obvious over the Crochet Application

Applicants have obtained an English translation of the Crochet Application, a copy of which is attached herewith. Applicants first provide general comments on the Crochet patent and the differences with preferred embodiments of the present invention, and then address the rejections of the pending independent Claims 1, 10, and 13. The present invention is directed to achieving efficient coupling of signals with frequencies in the tens of GigaHertz (GHz) from a transmission line to a waveguide, as well efficient coupling of such signals in the reverse direction. Referring to FIG. 1 of the present application, preferred embodiments of the present invention achieve such coupling by providing a combination of a back-side via feed (32) of the signal to the patch antenna (24) with a ground ring (22) disposed on the substrate surface for coupling to the waveguide, and/or by providing a high-degree of impedance matching between the transmission line and the waveguide. The impedance matching is provided by a capacitive diaphragm (28) disposed along an edge of the patch antenna (24) and by the selection of the width W of the patch antenna (24). One feature of the increased impedance matching is the non-uniform gap between the patch antenna (24) and the conductive material of the capacitive diaphragm and ground ring. Referring to the example shown in FIG. 1 of the present application, the two sides that define the length (L) of the exemplary patch antenna (24) are closer to the ground ring (22) and capacitive diaphragm (28) than the distance between the ground ring and each of the two sides that define the width (W) of the exemplary patch antenna. This difference provides a non-uniform gap.

Owning to its age, the Crochet Application is directed to signals having frequencies in the hundreds of MegaHertz (MHz) range, not in the tens of GHz range. Moreover, based on the dimensions of the Crochet's waveguides relative to the depicted size of the coaxial feed lines used by Crochet, it can be deduced that his frequency signals are in the range of hundreds of

MHz. The Crochet Application describes two prior art configurations in its FIGS. 1a and 1b, to which Crochet's invention is to replace for the advantages of lower manufacturing costs and reduced insertion losses, not for the advantage of increased frequency performance. These prior art configurations have discrete radiating elements (4) that have to be several millimeters (mm) long and at least one millimeter wide in order to manufacture and tune. These elements (4) are, in turn, fed by a common coaxial line comprising an inner conductor (1) and a cylindrical ground (2) which surrounds inner conductor. The coaxial feed line would be on the order of 5 to 10 mm. Crochet shows the use of the same coaxial feed line in the embodiments of his invention shown in his FIGS. 3d, 6a, and 6b. These figures of the Crochet Application show the waveguide dimensions to be significantly larger than the dimensions of the coaxial feed, substantially on the order of at least 20 mm by 60 mm, if not at least 30 mm by 90 mm. In comparison, the waveguide dimension for Applicants' 76 GHz application is 1.55 mm by 3.10 mm (Applicants' Specification, page 14, line 4), which is significantly smaller than the coaxial feed line shown in FIGS. 1a, 1b, 3d, 6a, and 6b of the Crochet Application. The significantly larger dimensions of Crochet's wavguides indicate that his signal frequencies are significantly lower than those that can be handled by Applicants' invention (*e.g.*, at least 13 to 19 times lower).

When Crochet uses a back-side feed, he does not use a front-side ground ring. Because Crochet deals with relatively low frequencies, he does not recognize the need for a front-side ground ring when using a back-side via feed. In the Crochet device, there is a dielectric gap of a few millimeters (i.e., the thickness of his dielectric substrate 7) between the waveguide lip and the back-side ground plane. However, the wavelengths of Crochets signals are at least 50 mm, which are significantly longer than the width of the dielectric gap, and thus there is relatively little impact. However, the wavelength of a 76 GHz frequency is 4 mm, which relatively close to the thickness of the substrate, and often sufficient to allow the electromagnetic signals to radiate from the gap (and thus leak energy from the gap) because the gap is on the order of ½ to ¼ of a wavelength, and because a lack of a front-side ground ring allows the end of the waveguide and the back-side ground plane to have different "ground" potentials. However, this leakage problem is not seen or recognized by the Crochet Application.

While the Crochet Application shows a front-side ground plane 9 in its FIGS. 3b and 4, this ground plane is part of the co-planar feed line structure formed by trace 6 and ground plane 9, and is not a recognition of the leakage effects at the above-mentioned gap.

In addition, there is no mention or recognition in the Crochet Application of the need to for impedance matching between the patch antenna and the waveguide. In Crochet's FIGS. 3b and 4, there is a uniform gap between antenna 5 and ground plane 9, indicating that no attempt has been made to match the impedance of antenna to the waveguide. The uniform gap between antenna 5 and ground plane 9 is the same as the uniform gap between feed trace 6 and ground plane 9. It is known in the art that this uniform gap is used to set the characteristic impedance between trace 6 and ground plane 9. Thus, it appears that Crochet has extended this uniform gap to antenna 5 for the purpose of matching the characteristic impedance of antenna 5 with respect to ground plane 9 to that of trace 6 with respect to ground plane 9. This matching is not the same as matching the impedance of the *antenna* to the *waveguide*.

Specific Response to the Rejection of Independent Claim 1 and its dependent Claims 2-9

Claim 1 has been amended to include the features of original dependent Claim 3. Claim 1 now recites a combination of a back-side via feed (32) of the signal to the patch antenna (24) with a ground ring (22) disposed on the substrate surface for coupling to the waveguide. This combination is not taught or suggested by the Crochet Application. The Crochet Application shows back-side feeding in the embodiments shown in its figures 3c, 3d, 6a, and 6b. The Crochet Application does not teach or suggest a front-side ground ring for any of these embodiments. A front-side ground is not needed for these feeding arrangements. In the Office Action, the Examiner has analogized Crochet's ground plane 9 to Applicants' ground ring 22. However, as indicated above, the ground plane 9 (which the translation calls a conductive plane) is part of the coplanar feeding structure to the antenna for another of Crochet's embodiments. The Crochet Application makes this clear:

> "Figure 3b shows a rectangularly shaped radiating element 5; however, this figure illustrates above all the possibility of energizing this radiating element 5 via a coplanar line comprised of a conducting strip 6 and the conducting plate 9 surrounding the radiating element 5 unit while however remaining electrically insulated from it. In that case the conducting plate 8 acts as a reflector for the ultra-high frequency waves." (Translation at page 3 lines 33-38)

Thus, the rejection of original Claim 3, as now applicable to amended Claim 1, effectively combined a feature from one signal feeding structure (coplanar feed) with those of another feeding structure (back-side feed) in order to construct Claim 3. However, both the art and the

Crochet Application regard these feeding structures as being separate and distinct, whose features are not combinable or interchangeable. Accordingly, there is no motivation in the prior art to make the combination that the rejection has proffered, and this proffered combination can only be supported by impermissible picking and choosing of features from separate apparatuses guided by hindsight of the present invention. Accordingly, Applicants respectfully submit that the *prima facie* rejection of Claim 1 and its pending dependent Claims 2, and 4-9 lacks a proper foundation, and that Claims 1 and its pending dependent claims are novel and non-obvious over the Crochet Application.

As to the Rejection of Claim 7, Applicants provide the following additional reasons for patentability. The rejection of Claim 7 associated the uniform-width gap between the antenna 9 and conductive plate 5 shown in FIGS. 3b and 4 of the Crochet Application with the capacitive diaphragm recited by Claim 7. Claims 7 has been amended to indicate that the capacitive diaphragm comprises conductive material. With this amendment, it is now clear that Crochet's gap is not analogous to the capacitive diaphragm recited by amended Claim 7 since the capacitive diaphragm comprises conductive material and cannot be a gap.

As to the obviousness rejection of Claim 6, Applicants provide the following additional reasons for patentability. The Wei patent is an example of a quarter-wavelength metal back-short device, as indicated at column 3, lines 12-14 of the Wei Patent. In the Wei device, a circuit board is inserted at a quarter-wavelength from the end of the waveguide, which is shorted by a back-plane (Q3). This is a different approach than that of the Crochet Application, where the back plate 8 is integrated onto the circuit board, and the thickness of the circuit board is much less than a quarter-wavelength, as indicated in Applicants' general remarks on the Crochet Application. Thus, the Crochet and Wei devices are considered by the art to be two separate types of excitation devices whose features are not viewed as being combinable or interchangeable.

Specific Response to the Rejection of Independent Claim 10 and its dependent Claims 11-12

As indicated above, Claim 10 has been amended to recite that the ground ring and the capacitive diaphragm comprise conductive material. Claim 10 has also been amended to recite a gap between the patch antenna and the conductive material of the ground ring and capacitive diaphragm, with the gap having a non-uniform width. The rejection of Claim 10 associated the

uniform-width gap between the antenna 9 and conductive plate 5 shown in FIGS. 3b and 4 of the Crochet Application with the capacitive diaphragm recited by Claim 10. With this amendment, it is now clear that Crochet's gap is not analogous to the capacitive diaphragm recited by amended Claim 10 since the capacitive diaphragm comprises conductive material. Moreover, as indicated above, the non-uniform-width gap recited by amended Claim 10 is for improving the impedance matching between the patch antenna and the waveguide. In contrast, the Crochet Application shows a uniform-width gap, which is chosen for a very different purpose, as indicated above. Accordingly, Applicants respectfully submit that Claim 10 and its dependent Claims 11, 12, and 23 are not taught or suggested by the Crochet Application, and are allowable thereover.

Specific Response to the Rejection of Independent Claim 13 and its dependent Claims 14-20

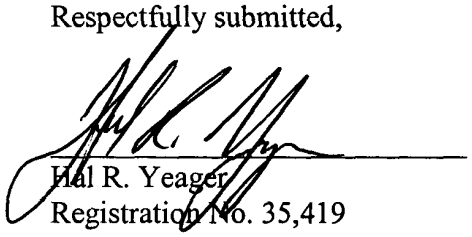
With this Amendment, Independent Claim 13 has been amended to include its dependent Claim 18. Claim 18 was not rejected under 35 U.S.C. §§102 and 103, and was only objected to. Those objections have been addressed with the amendments to Claim 13. Accordingly, Applicants respectfully submit that pending rejection to Claim 13 has been addressed by the incorporation of Claim 18 therein.

CONCLUSION

In view of the remarks made above, Applicants respectfully submit that the application is in condition for allowance and action to that end is respectfully solicited. If the Examiner should feel that a telephone interview would be productive in resolving issues in the case, he is invited to telephone the undersigned at the number listed below.

July 21, 2003

Respectfully submitted,



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Attachments

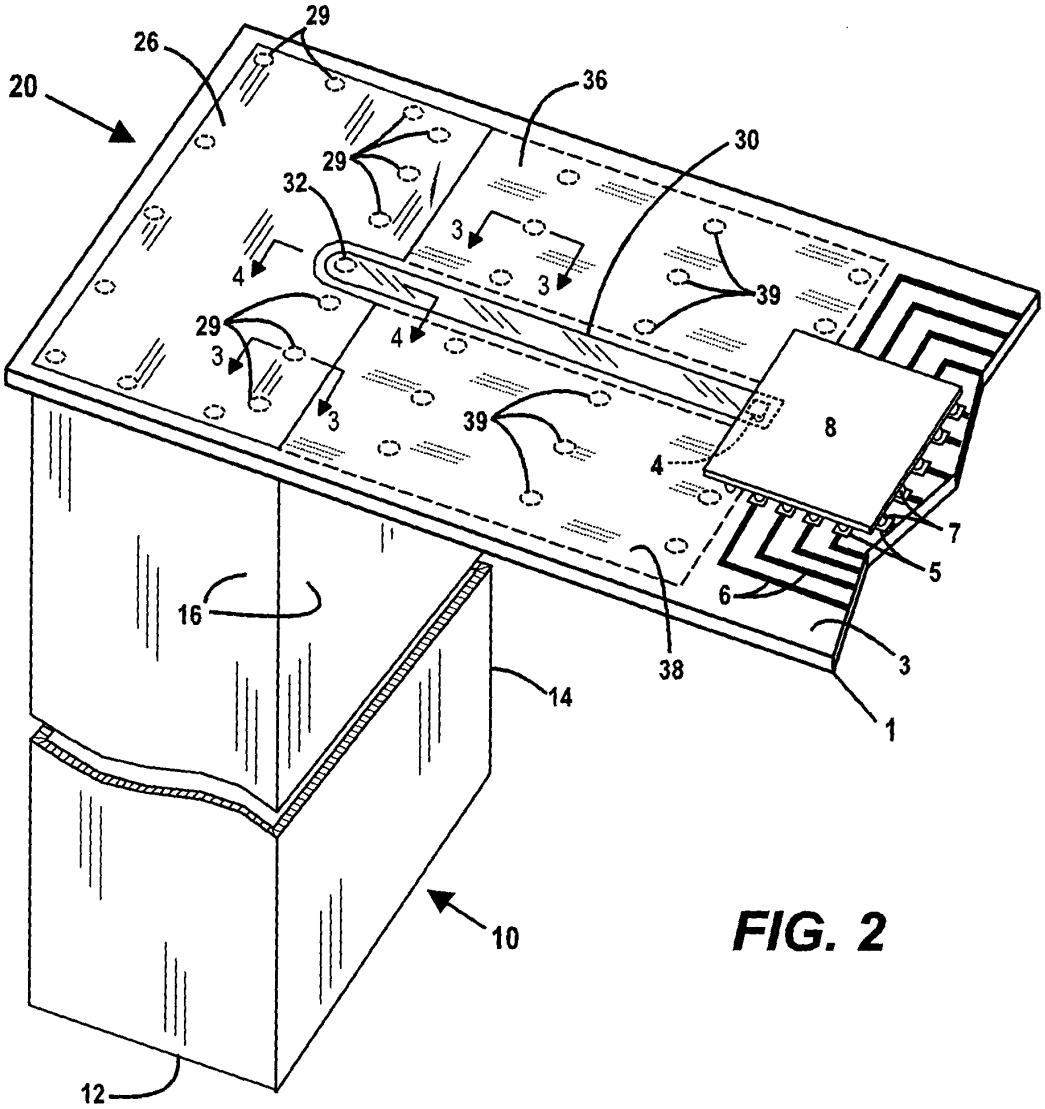


FIG. 2

FIG. 3

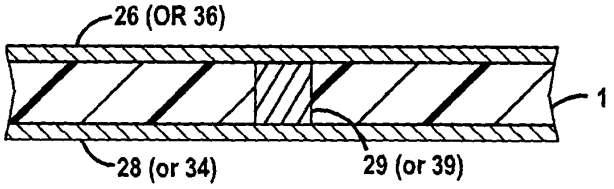
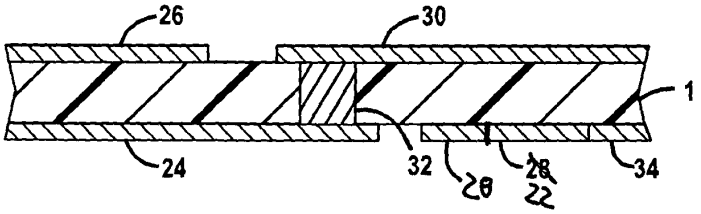


FIG. 4



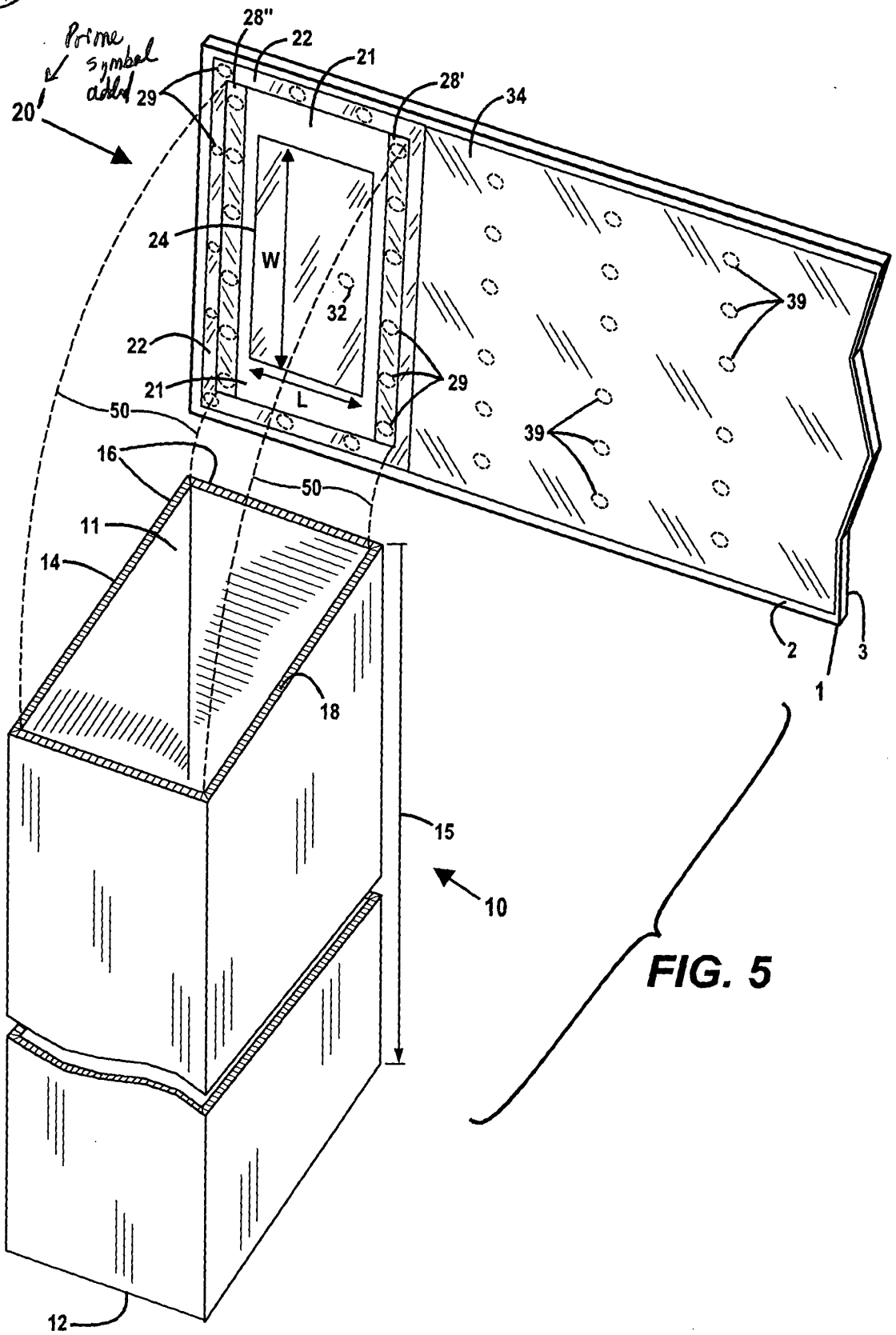


FIG. 5

By Added Figure

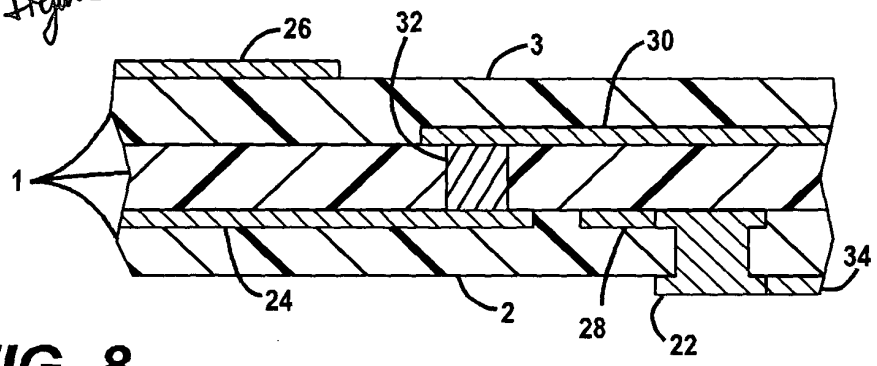


FIG. 8